

CLAIMS

What is claimed is:

1. A method for on-demand management of Internet Protocol (IP) address pools, the method comprising:  
  
allocating an unused IP address from a local IP address pool designated for a remote domain if a request to connect to said remote domain is received, said local IP address pool comprising one or more of at least one subnet obtained from a global IP address pool, each of said at least one subnet specifying a contiguous set of one or more IP addresses;  
  
deallocating an IP address back to said local IP address pool if said IP address is unused; and  
  
apportioning one or more of said at least one subnet between said global IP address pool and said local IP address pool based upon utilization of said local IP address pool.
2. The method of claim 1, further comprising configuring said local IP address pool with a subnet from said at least one subnet.
3. The method of claim 1 wherein said apportioning comprises:  
  
requesting one or more subnet from said global IP address pool if utilization of said local IP address pool exceeds a first threshold; and  
  
releasing one or more subnet to said global IP address pool if utilization of said local IP address pool falls below a second threshold.

4. The method of claim 3 wherein said apportioning further comprises polling said local IP address pool at predetermined intervals to obtain local IP address pool utilization information.
5. The method of claim 3 wherein  
said requesting further comprises requesting a subnet having first predetermined number of IP addresses; and  
said releasing further comprises releasing a subnet having a second predetermined number of IP addresses.
6. The method of claim 3 wherein  
said requesting further comprises requesting a subnet having a size that is relative to a current subnet size; and  
said releasing further comprises releasing a subnet having a size that is relative to said current subnet size.
7. The method of claim 3 wherein  
said requesting further comprises requesting a subnet having a size that is relative to an initial subnet size; and  
said releasing further comprises releasing a subnet having a size that is relative to said initial subnet size.

8. The method of claim 3 wherein
- said requesting further comprises requesting a subnet having a size that is relative to a current subnet size; and
- said releasing further comprises releasing a subnet having a size that is relative to said current subnet size.
9. The method of claim 3 wherein said releasing further comprises removing the summarized route for said one or more subnet from a routing table associated with said local IP address pool.
10. The method of claim 8 wherein said method further comprises inserting a route summary for said requested one or more subnet if said requested one or more subnet is received.
11. The method of claim 8 wherein said method further comprises:
- inserting a route summary for a received one or more subnet and requesting one or more subnet if the size of said received one or more subnet is less than the size of said requested one or more subnet;
- inserting a route summary for said received one or more subnet if the size of said received one or more subnet equals the size of said requested one or more subnet;
- inserting a route summary for said received one or more subnet if the size of said received one or more subnet is greater than the size of said requested one or more subnet and if the resulting local IP address pool utilization falls below said second threshold; and

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rejecting said received one or more subnet and requesting one or more subnet if the size of said received one or more subnet is greater than the size of said requested one or more subnet and if the resulting local IP address pool utilization does not fall below said second threshold.

12. The method of claim 1 wherein said remote domain comprises a virtual private network (remote domain).
13. A program storage device readable by a machine, embodying a program of instructions executable by the machine to perform a method for on-demand management of Internet Protocol (IP) address pools, the method comprising: allocating an unused IP address from a local IP address pool designated for a remote domain if a request to connect to said remote domain is received, said local IP address pool comprising one or more of at least one subnet obtained from a global IP address pool, each of said at least one subnet specifying a contiguous set of one or more IP addresses; deallocating an IP address back to said local IP address pool if said IP address is unused; and apportioning one or more of said at least one subnet between said global IP address pool and said local IP address pool based upon utilization of said local IP address pool.

14. The program storage device of claim 13, said method further comprising configuring said local IP address pool with a subnet from said at least one subnet.
15. The program storage device of claim 13 wherein said apportioning comprises:
- requesting one or more subnet from said global IP address pool if utilization of said local IP address pool exceeds a first threshold; and
- releasing one or more subnet to said global IP address pool if utilization of said local IP address pool falls below a second threshold.
16. The program storage device of claim 15 wherein said apportioning further comprises polling said local IP address pool at predetermined intervals to obtain local IP address pool utilization information.
17. The program storage device of claim 15 wherein
- said requesting further comprises requesting a subnet having first predetermined number of IP addresses; and
- said releasing further comprises releasing a subnet having a second predetermined number of IP addresses.
18. The program storage device of claim 15 wherein
- said requesting further comprises requesting a subnet having a size that is relative to a current subnet size; and
- said releasing further comprises releasing a subnet having a size that is relative to said current subnet size.

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19. The program storage device of claim 15 wherein
- said requesting further comprises requesting a subnet having a size that is relative to an initial subnet size; and
- said releasing further comprises releasing a subnet having a size that is relative to said initial subnet size.
20. The program storage device of claim 15 wherein
- said requesting further comprises requesting a subnet having a size that is relative to a current subnet size; and
- said releasing further comprises releasing a subnet having a size that is relative to said current subnet size.
21. The program storage device of claim 15 wherein said releasing further comprises removing the summarized route for said one or more subnet from a routing table associated with said local IP address pool.
22. The program storage device of claim 20 wherein said method further comprises inserting a route summary for said requested one or more subnet if said requested one or more subnet is received.
23. The program storage device of claim 20 wherein said method further comprises:
- inserting a route summary for a received one or more subnet and requesting one or more subnet if the size of said received one or more subnet is less than the size of said requested one or more subnet;

inserting a route summary for said received one or more subnet if the size of said received one or more subnet equals the size of said requested one or more subnet; inserting a route summary for said received one or more subnet if the size of said received one or more subnet is greater than the size of said requested one or more subnet and if the resulting local IP address pool utilization falls below said second threshold; and rejecting said received one or more subnet and requesting one or more subnet if the size of said received one or more subnet is greater than the size of said requested one or more subnet and if the resulting local IP address pool utilization does not fall below said second threshold.

24. The program storage device of claim 13 wherein said remote domain comprises a virtual private network (remote domain).
25. An apparatus for on-demand management of Internet Protocol (IP) address pools, the apparatus comprising:
- means for allocating an unused IP address from a local IP address pool designated for a remote domain if a request to connect to said remote domain is received, said local IP address pool comprising one or more of at least one subnet obtained from a global IP address pool, each of said at least one subnet specifying a contiguous set of one or more IP addresses;
  - means for deallocating an IP address back to said local IP address pool if said IP address is unused; and

means for apportioning one or more of said at least one subnet between said global IP address pool and said local IP address pool based upon utilization of said local IP address pool.

26. The apparatus of claim 25, further comprising means for configuring said local IP address pool with a subnet from said at least one subnet.
27. The apparatus of claim 25 wherein said means for apportioning comprises:  
means for requesting one or more subnet from said global IP address pool if utilization of said local IP address pool exceeds a first threshold; and  
means for releasing one or more subnet to said global IP address pool if utilization of said local IP address pool falls below a second threshold.
28. The apparatus of claim 27 wherein said means for apportioning further comprises  
means for polling said local IP address pool at predetermined intervals to obtain local IP address pool utilization information.
29. The apparatus of claim 27 wherein  
said means for requesting further comprises means for requesting a subnet having first predetermined number of IP addresses; and  
said means for releasing further comprises means for releasing a subnet having a second predetermined number of IP addresses.



30. The apparatus of claim 27 wherein

said means for requesting further comprises means for requesting a subnet having a size that is relative to a current subnet size; and

said means for releasing further comprises means for releasing a subnet having a size that is relative to said current subnet size.

31. The apparatus of claim 27 wherein

said means for requesting further comprises means for requesting a subnet having a size that is relative to an initial subnet size; and

said means for releasing further comprises means for releasing a subnet having a size that is relative to said initial subnet size.

32. The apparatus of claim 27 wherein

said means for requesting further comprises means for requesting a subnet having a size that is relative to a current subnet size; and

said means for releasing further comprises means for releasing a subnet having a size that is relative to said current subnet size.

33. The apparatus of claim 27 wherein said means for releasing further comprises means

for removing the summarized route for said one or more subnet from a routing table associated with said local IP address pool.

34. The apparatus of claim 32 wherein said apparatus further comprises means for inserting a route summary for said requested one or more subnet if said requested one or more subnet is received.
35. The apparatus of claim 32 wherein said apparatus further comprises:
- means for inserting a route summary for a received one or more subnet and means for requesting one or more subnet if the size of said received one or more subnet is less than the size of said requested one or more subnet;
  - means for inserting a route summary for said received one or more subnet if the size of said received one or more subnet equals the size of said requested one or more subnet;
  - means for inserting a route summary for said received one or more subnet if the size of said received one or more subnet is greater than the size of said requested one or more subnet and if the resulting local IP address pool utilization falls below said second threshold; and
  - means for rejecting said received one or more subnet and means for requesting one or more subnet if the size of said received one or more subnet is greater than the size of said requested one or more subnet and if the resulting local IP address pool utilization does not fall below said second threshold.
36. The apparatus of claim 25 wherein said remote domain comprises a virtual private network (remote domain).

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37. An apparatus for on-demand management of Internet Protocol (IP) address pools, the apparatus comprising:

an allocator to allocate an unused IP address from a local IP address pool designated for a remote domain if a request to connect to said remote domain is received, said local IP address pool comprising one or more of at least one subnet obtained from a global IP address pool, each of said at least one subnet specifying a contiguous set of one or more IP addresses, said allocator coupled to said local IP address pool;

a deallocator to deallocate an IP address back to said local IP address pool if said IP address is unused, said deallocator coupled to said local IP address pool; and

a monitor to apportion one or more of said at least one subnet between said global IP address pool and said local IP address pool based upon utilization of said local IP address pool, said monitor coupled to said local IP address pool and a global IP address pool interface.

38. The apparatus of claim 37, further comprising an IP address configurer to configure said local IP address pool with a subnet from said at least one subnet.

39. The apparatus of claim 37 wherein said monitor comprises:

a utilization assessor to assess utilization of said local IP address pool, said utilization assessor coupled to said local IP address pool;

a subnet requestor to request a subnet from said global IP address pool if utilization of said local IP address pool exceeds a first threshold;

a subnet receiver to receive said requested subnet and to forward said requested subnet to said local IP address pool, said subnet receiver coupled to said local IP address pool and said global IP address pool interface; and

a subnet returner to return a subnet to said local IP address pool if said utilization assessor indicates utilization of said local IP address pool is below a second threshold, said subnet returner coupled to said local IP address pool and said global IP address pool interface.

40. The apparatus of claim 39 wherein said utilization assessor is further configured to poll said local IP address pool at predetermined intervals to obtain local IP address pool utilization information.

41. The apparatus of claim 39 wherein

said subnet requestor is further configured to request a subnet having first predetermined number of IP addresses; and

said subnet returner is further configured to release a subnet having a second predetermined number of IP addresses.

42. The apparatus of claim 39 wherein

said subnet requestor is further configured to request a subnet having a size that is relative to a current subnet size; and

said subnet returner is further configured to release a subnet having a size that is relative to said current subnet size.

43. The apparatus of claim 39 wherein

said subnet requestor is further configured to request a subnet having a size that is relative to an initial subnet size; and

said subnet returner is further configured to release a subnet having a size that is relative to said initial subnet size.

44. The apparatus of claim 39 wherein

said subnet requestor is further configured to request a subnet having a size that is relative to a current subnet size; and

said subnet returner is further configured to release a subnet having a size that is relative to said current subnet size.

45. The apparatus of claim 39 wherein said subnet returner is further configured to remove the summarized route for said one or more subnet from a routing table associated with said local IP address pool.

46. The apparatus of claim 44 wherein said subnet receiver is further configured to insert a route summary for said requested one or more subnet if said requested one or more subnet is received.

47. The apparatus of claim 44 wherein said subnet receiver is further configured to:

insert a route summary for a received one or more subnet and requesting one or more subnet if the size of said received one or more subnet is less than the size of said requested one or more subnet;

insert a route summary for said received one or more subnet if the size of said  
received one or more subnet equals the size of said requested one or more subnet;  
insert a route summary for said received one or more subnet if the size of said  
received one or more subnet is greater than the size of said requested one or more  
subnet and if the resulting local IP address pool utilization falls below said  
second threshold; and  
reject said received one or more subnet and requesting one or more subnet if the size  
of said received one or more subnet is greater than the size of said requested one  
or more subnet and if the resulting local IP address pool utilization does not fall  
below said second threshold.

48. The apparatus of claim 37 wherein said remote domain comprises a virtual private  
network (remote domain).
49. The apparatus of claim 37 wherein  
said global IP address pool comprises an Authentication, Authorization and  
Accounting (AAA) server; and  
said global IP address interface comprises an AAA proxy configured to communicate  
with said AAA server using the RADIUS protocol.
50. The apparatus of claim 37 wherein  
said global IP address pool comprises a Dynamic Host Configuration Protocol  
(DHCP) server; and

said global IP address interface comprises a Ring Access Controller (RAC) client  
configured to communicate with said DHCP server using the DHCP protocol.

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